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ABSTRACT

Similarities in cognitive, attitudinal, and environmental factor structures of 60 Canadian Indian and 91 White students in grades 4, 6, and 8 were analyzed and compared to determine if learning difficulties of Indian students stemmed from those factors. White and Indian cognitive factor structures were most similar, and attitudinal factor structures were least similar. Attitudinal and environmental factors were clearly differentiated for Indians, but not for Whites. Multiple regression analysis indicated that school and race were significant predictors of cognitive factor and that grade, school, and the interactions of sex x race and grade x school were significant predictors of environmental factor. Because learning difficulties of Indian students may be related to differences between their personal attitudes and values and those of the school personnel, it was suggested that recognition of sociocultural differences in values and attitudes may be vital to the development of effective programs for Indian children and for all minority groups. (Author/CM)

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Cognitive, Attitudinal, and Environmental Factors of Canadian Indian and White Students[1]

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Abstract

Similarities in factor structures of cognitive, attitudinal, and environmental factors of 60 Canadian Indian and 91 White children were investigated. Factor analysis of the battery of tests produced three principal factors: cognitive, attitudinal, and environmental. White and Indian factor structures were most similar on cognitive, and least on attitudinal. Attitudinal and environmental factors were clearly differentiated for Indians but not for Whites. Multiple regression analysis indicated that school and race were significant predictors of cognitive factor and that grade, school, and the interactions of sex x race and grade x school were significant predictors of environmental factor. Implications for understanding and improving education were discussed.

Cognitive, Attitudinal, and Environmental Factors of Canadian Indian and White Students

Studies of the educational achievement of Canadian Indian Children have consistently revealed underachievement. The educational needs of Indian children are not being realized in Canadian schools. The evidence for this is found in statistics on Indian students' under-enrolment, absenteeism, dropouts, and overageness. The Federation of Saskatchewan Indians (1973) commissioned a report on Indian education in Saskatchewan. Using 1969-70 statistics, the authors reported that by grade 4 more than half of the Indian students were two or more years older than the expected age for their grade and that two-thirds of Indian students in grade 8 were two or more years behind. The report stated that less than 5% of Indian students eventually completed grade 12. Statistics for the 1974-75 year (Hoople & Newbery, 1976) showed that 80.9% of all status Indian children dropped out before completing high school and only 1% of all Indian students in Canada were attending university.

It appears that, despite expanded educational opportunities, Indian students have not achieved success in the present educational system. The major purpose of this study was to analyze and compare the cognitive, attitudinal, and environmental factors of Canadian Indian and White children. A study of the similarities of the environmental and attitudinal structures of Indian and White children may provide educationists some clues for understanding the educational problems of Indian students. That is, their learning difficulties may stem from the social climate (environment) of the classroom and/or personal attitudes and values.

The application of Lewin's field theory to education implies that learning is related to characteristics within the learner (abilities, attitudes, and so on) and to the learning environment (the climate, organization, and culture of

the school). The Coleman (1966) report, which investigated the critical factors relating to the education of minority children, concluded that attitudinal variables, self-concepts, success in school, and sense of control of the environment, had the strongest relationship to achievement. Aspects of the social-psychological environment of the classroom have also been found to be related to the academic achievement of students (Moos & Moos, 1978; Walberg & Anderson, 1972).

The majority of research relating student attitudes and the learning environment of the classroom to achievement has been conducted with White children but very little has been done in this area with Indian students. The purpose of the present study was to investigate the underlying structures of cognitive, attitudinal, and environmental variables in a group of Canadian Indian and White students. It was hypothesized that the factor structures would be different for the two racial groups and that the variables of grade, school, sex, and race would differentially predict the cognitive, attitudinal, and environmental factors.

Method

Sample

The sample of 170 subjects consisted of 75 Indian and 95 White students in grades 4, 6, and 8 from three schools, one federal school on an Indian Reservation and two (joint) provincial schools. All Indian students in the study were from a reservation in North-central Saskatchewan. The sample was selected on the basis of accessibility and willingness to cooperate. Because of missing data, the sample in the final analyses was reduced to 60 Indian and 91 White students.

Procedure

The subjects were given the Raven's Standard Progressive Matrices, My Class

Inventory (Anderson & Walberg, 1973), Canadian Test of Basic Skills (CTBS) and nine semantic differential (SD) attitude scales. The Raven's Progressive Matrices test was used as a non-verbal test of intellectual ability. Several studies have shown its suitability for testing Indian students (MacArthur, 1968; West and MacArthur, 1964; Wilson, 1973). The My Class Inventory (MCI), which is a downward extension of the Learning Environment Inventory (LEI), was used to measure students' perceptions of the social-psychological environment of the classroom. The MCI contains 45 items distributed over the scales satisfaction, friction, competitiveness, difficulty, and cohesiveness. Achievement scores were derived from the CTBS subtests of Vocabulary, Reading, Language Skills, and Mathematics. The SD utilized 12 adjective pairs to measure students' attitudes toward nine concepts: School, Teachers, My Success in School, Myself as a Person, Indian, White Man, My Present Life, My Future, and Education.

The Raven's Progressive Matrices and CTBS scores were converted to standard scores; MCI and semantic differential raw scores were used.

Analysis, Results, and Discussion

The 12 scale scores of each attitudinal concept were submitted to factor analysis in order to determine whether a specific attitude scale was unidimensional or multidimensional. In each case, only one factor with eigen value greater than 1.0 emerged and accounted for more than 50% of the total variance and it was concluded that these scales could be considered as unidimensional.

The correlation matrices of the 19 variables for Indian and White students are given in Table 1. The correlation matrix for the combined group is given in Table 2. Each matrix was analyzed by the method of iterative principal

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Insert Tables 1 and 2 about here.

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components (Harman, 1967). Three principal components were retained and transformed to simple structure using the normalized varimax procedure (Kaiser, 1958). The decision to retain three components for subsequent transformation was based on the examination of the residual correlation matrices after the original matrix was estimated by successive retention of the principal components. The factor matrix for the total or combined group is given in Table 3.

The three components for the Indian group were further orthogonally rotated to make the factor solution as similar as possible to the solution obtained for

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Insert Table 3 about here.

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the White group. The congruence procedure of Cliff (1966) for such transformation was used. This congruence procedure seeks an orthogonal transformation such that when applied to the matrix of interest, the transformation makes the matrix of interest maximally similar to the criterion matrix. The factor structures of the two groups were then tested with the coefficient of congruence in order to examine the extent to which the two factors were similar. The obtained coefficients are evaluated subjectively because no statistical test of significance is available. Evans (1970) suggests coefficients of .90 or higher indicate "good" correspondence, coefficients from .70 to .80 indicate "poor" correspondence, and coefficients lower than .70 show no correspondence between a pair of factors.

The three principal factor scores of the total group were used as criterion variables in multiple regression analysis in order to determine whether the dummy vectors of grade, school, grade x school, sex, race, sex x race, and race x school would differentially predict each criterion. For each factor score, two regression analyses were done. The first analysis employed a predetermined order for the addition of successive dummy vectors in order to determine the contribution of the vectors which made up a categorical variable when entered together on one step.

The second regression analysis employed a stepwise procedure with unspecified order of dummy vectors to determine which of these were the best predictors when they had to compete with the other vectors.

The factors for the White sample and the congruent factors for the Indian sample are presented in Table 4. Three common factors were obtained for the White sample. The Raven's test and achievement tests defined one factor

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Insert Table 4 about here.

(Cognitive); five semantic differential concepts of My Success in School, Myself as a Person, White Man, My Present Life, and My Future defined a second factor (attitudinal); the MCI scales (except competitiveness) and the semantic differential concepts of school, teachers, Indian and education defined a third factor (environmental). In the original varimax matrix for the Indian sample, two of the factors were more clearly differentiated and specific than for the White group. For the Indian sample, the attitudinal factor was purely and distinctly a semantic differential factor and the environmental factor was purely a MCI factor. In the congruent matrix (Table 4), there was a slight displacement of three variables with My Success in School and White Man moving toward the environmental factor and the MCI scale of competitiveness moving into the attitudinal factor. The congruence coefficients were .93, .80, and .86 for Factors I, II, and III respectively.

Multiple regression analysis using Factor I as the criterion variable and a predetermined order of the seven categorical variables as predictor variables indicated that the seven predictor variables together explained 30.7% of the total variance in the cognitive factor. School was a significant predictor of Factor I accounting for 11.8% of the total variance (see Table 5 for Regression Model and Table 6 for ANOVA table and F-ratios). Race also significantly predicted the

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Insert Tables 5 and 6 about here.

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cognitive factor and contributed 16.3% to the total variance.

The multiple regression analysis using the stepdown procedure indicated that Race was the single best predictor of the cognitive factor explaining 26.9% of the total variance [$F(1,149)=53.94$, $p \leq .01$]. An examination of the means and S.D. of the Ravens and CTBS scores, given in Table 7, which made up the cognitive

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Insert Table 7 about here.

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factor indicates that the White group achieved higher mean scores on these five tests than the Indian group.

Multiple regression on Factor II reported in Tables 5 and 6 indicated that the predictor variables accounted for only 13.2% of the variance in the attitudinal factor. When the order of the variables was specified, sex was a significant predictor of Factor II accounting for 2.6% of the total variance. School also significantly predicted Factor II and contributed 4.1% to the total variance. The total regression equation did not reach significance. When the variable order of entry into the equation was unspecified, sex entered the equation second and no longer made a significant contribution.

Using Factor III as the criterion variable, multiple regression analysis indicated that the seven predictor variables accounted for 42.1% of the variance in the environmental factor. Sex accounted for 2.1% of the variance in Factor III while grade accounted for 13.5% and school for 9.6%. The interaction of sex x race accounted for 6.1% of the variance while the interaction of grade x school accounted for 10.6% of the total variance. When the order of entry into the regression equation was unspecified, sex was no longer a significant predictor of the environmental factor, although the sex x race interaction variable

was still a significant predictor entering on the fourth step and explaining 4.6% of the total variance [$F(1,149)=11.22$, $p \leq .01$]. The finding that grade is the best predictor of the environmental factor suggests that grade level influences the psycho-social atmosphere of the classroom. This could be related to the age level of the students and/or the expectations teachers have of that particular age level.

As the attitudinal factor structures of Indians and Whites are most dissimilar, it is possible that the learning difficulties of Indian students may be related to differences between their personal attitudes and values and that of the school personnel. Other researchers have found differences in the value orientations between Indian and non-Indian students (Friesen, 1974) and between Indian students and their teachers (Gue, 1971). It is generally agreed that the values emphasized in the classroom tend to reflect the white middle class perspective. It is thus reasonable to assume that Indian children who have had a different sociocultural influence will find the values and attitudes of the classroom alien or incompatible with the values emphasized in their homes. As a country that prides itself for a pluralistic society and encourages minority groups to retain their cultural identities, the challenge to educators is to facilitate this process. In some provinces, such as Saskatchewan, Indian leaders appear to be no longer willing to wait for the present education system to accommodate their students and they have started running their own schools.

In the past it seems that educators have expected minority groups to be assimilated into the larger society and thus adopt the dominant values and attitudes toward education. Perhaps it is time to look within the school system for ways to accommodate minority groups rather than expect minority groups to subjugate their cultural identity to the majority.

The school system has often stressed the importance of teachers being

cognizant of and reacting to individual differences between students and this has been done to a great extent in relation to differential abilities and levels of achievement. Perhaps, now steps should be taken to recognize and react appropriately to sociocultural differences in values and attitudes. In order to develop effective programs for minority groups and to facilitate effective communication between school and community, recognition of differences in value orientations may be vital. Realizing the differences in value orientations of various student groups, we may begin to develop programs to accommodate these groups and, hopefully, aid the achievement of all students.

The differential predictability of cognitive, attitudinal, and environmental factors by context variables should lead researchers to further investigation into differences between schools, grades, etc. that affect attitudes, achievement, and psychosocial climate. The present study has provided important initial data for further research in this area.

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TABLE 1

Indian and White Correlation Matrices[1]

Scales/Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. School Scale		44	60	13	22	30	38	41	50	10	-36	20	02	16	-27	05	11	-05	07
2. Teachers	79		49	19	15	43	27	31	32	17	-19	-05	-18	09	03	-26	00	-16	-19
3. My Success in School	57	54		49	18	45	54	50	63	09	-22	13	-02	20	-04	-30	-19	-33	-16
4. Myself as a Person	08	05	39		57	27	55	72	57	-08	08	-04	-27	-10	17	-33	-16	-12	-14
5. Indian	20	31	14	-10		03	54	49	55	-02	07	-12	-36	-07	06	-20	-08	01	01
6. White Man	33	20	49	58	-13		05	41	28	-12	-15	-10	04	24	-02	-15	-16	-33	-23
7. My Present Life	26	21	55	73	14	59		67	60	-09	-09	06	-24	-09	-06	-24	-12	-19	-06
8. My Future	06	14	47	56	06	53	68		64	-15	03	-12	-25	-07	06	-32	-19	-40	-16
9. Education	47	47	50	27	28	21	41	49		-01	-05	-09	-20	11	-05	-26	-16	-24	-09
10. Raven's	-17	-19	-10	15	-10	-02	08	01	-04		-06	-12	-30	17	-14	46	53	40	29
11. Satisfaction	-52	-48	-41	-23	-24	-24	-34	-10	-33	-01		-41	-30	-08	50	-21	-12	-07	-07
12. Friction	24	32	17	00	33	05	19	03	07	-02	-51		36	08	-36	10	12	08	19
13. Competitiveness	-10	-01	-08	-08	-08	-11	-14	-09	-12	-05	03	16		-04	-10	12	-04	09	16
14. Difficulty	40	32	37	07	01	07	05	-03	19	-14	-37	16	-10		-06	06	03	05	-09
15. Cohesiveness	-26	-24	-23	-12	-33	-17	-28	-18	-20	-08	46	-45	06	-23		-30	-13	00	-30
16. Vocabulary	-18	-10	-31	-07	-02	-16	-12	-13	-19	43	09	06	04	-12	08		72	59	60
17. Reading	-07	-02	-29	-03	-07	-09	-11	-16	-14	42	13	01	06	-19	10	78		60	47
18. Language	-16	-11	-22	02	-14	01	-05	-05	-13	41	-04	03	02	-06	11	62	66		39
19. Mathematics	-28	-20	-36	-04	-06	-15	-11	-09	-11	50	07	-05	09	-26	17	69	68	70	

[1] Correlations for Indians are above the diagonal, Whites are below.

TABLE 2

Combined Group Correlation Matrix Among 19 Variables[1]

Scales/Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. School		64	58	13	15	29	30	20	48	-04	-43	19	-05	30	-23	-11	-03	-12	-16
2. Teachers	64		51	05	16	21	25	16	41	-02	-37	16	-07	20	-17	-16	-05	-12	-17
3. My Success in School	58	51		45	07	47	54	48	54	-03	-30	12	-06	30	-10	-32	-27	-28	-30
4. Myself as a Person	13	05	45		06	43	65	64	39	00	-07	-07	-16	03	07	-17	-12	-07	-10
5. Indian	15	16	07	06		-26	14	08	28	17	-22	27	-11	-03	-30	21	21	15	20
6. White Man	29	21	47	43	-26		35	46	22	-23	-10	-11	-04	15	05	-31	-26	-27	-32
7. My Present Life	30	25	54	65	14	35		66	50	-09	-17	07	-16	-02	-09	-23	-18	-16	-15
8. My Future	20	16	48	64	08	46	66		57	-10	00	-07	-16	-01	02	-22	-19	-21	-16
9. Education	48	41	54	39	28	22	50	57		-02	-22	-01	-16	15	-11	-21	-15	-18	-12
10. Raven's	-04	-02	-03	00	17	-23	-09	-10	-02		-12	04	-13	-02	-22	47	50	44	4[illegible]
11. Satisfaction	-43	-37	-30	-07	-22	-10	-17	00	-22	-12		-49	-11	-22	51	-11	-07	-12	-07
12. Friction	19	16	12	-07	-27	-11	07	-07	-01	04	-49		25	10	-46	19	17	15	15
13. Competitiveness	-05	-07	-06	-16	-11	-04	-16	-16	-16	-13	-11	25		-07	-03	08	04	06	12
14. Difficulty	30	20	30	03	-03	15	-02	-01	15	-02	-22	10	-07		-12	-07	-11	-04	-20
15. Cohesiveness	-23	-17	-10	07	-30	05	-09	02	-11	-22	51	-46	-03	-12		-22	-15	-08	-16
16. Vocabulary	-11	-16	-32	-17	21	-31	-23	-22	-21	47	-11	19	08	-07	-22		81	68	73
17. Reading	-03	-05	-27	-12	21	-26	-18	-19	-15	50	-07	17	04	-11	-15	81		70	68
18. Language	-12	-12	-28	-07	15	-27	-16	-21	-18	44	-12	15	06	-04	-08	68	70		67
19. Mathematics	-16	-17	-30	-10	20	-32	-15	-16	-12	45	-07	15	12	-20	-16	73	68	67	

[1] Decimal points omitted.

TABLE 3

Varimax Factor Matrix for Combined Group Factors

Variables	I	II	III	b^2
1. School Scale	-12	27	69	56
2. Teachers	-13	21	60	42
3. My Success in School	-26	58	52	67
4. Myself as a Person	00	78	-03	61
5. Indian	30	09	29	18
6. White Man	-31	46	11	32
7. My Present Life	-06	76	19	61
8. My Future	-09	84	01	72
9. Education	-08	59	36	49
10. Raven's	56	-01	07	32
11. Satisfaction	-14	-02	-72	53
12. Friction	20	-14	51	32
13. Competitiveness	02	-23	06	06
14. Difficulty	-14	02	33	13
15. Cohesiveness	-23	07	-53	34
16. Vocabulary	86	-20	02	78
17. Reading	84	-12	02	72
18. Language	76	-13	-03	60
19. Mathematics	82	-11	-06	69

[1] Decimal points omitted.

TABLE 4

Criterion Factor Loading Matrix (Whites) and Congruent Factor Matrix for Indians[1]

Scales/Variables	Whites				Indians			
	I	II	III	h^2	I	II	III	h^2
1. School Scale	-15	16	77	65	11	36	67	60
2. Teachers	-08	11	79	65	-10	37	34	26
3. My Success in School	-26	55	51	63	-22	54	59	69
4. Myself as a Person	08	80	-02	65	-13	75	02	58
5. Indian	-05	-04	39	16	06	68	-07	47
6. White Man	-03	68	13	48	-27	24	36	26
7. My Present Life	02	86	21	78	-06	69	23	54
8. My Future	-04	77	03	60	-22	79	19	71
9. Education	-10	41	43	36	-09	75	30	66
10. Raven's	54	11	-10	32	59	09	02	36
11. Satisfaction	-03	-21	-69	52	-11	15	-67	49
12. Friction	08	00	51	26	07	-23	45	26
13. Competitiveness	04	-14	-03	02	-10	-47	31	33
14. Difficulty	-17	04	43	21	03	-02	21	04
15. Cohesiveness	03	-17	-45	23	-22	15	-48	30
16. Vocabulary	83	-16	-03	71	83	-30	11	79
17. Reading	84	-13	-02	72	81	-08	05	67
18. Language	77	-02	-05	60	69	-18	-12	52
19. Mathematics	84	-10	-16	74	59	-13	09	37

[1] Decimal points are omitted.

TABLE 5

Increments in Achievement Variance[a] (R^2) Accounted for by Complete Regression Models

Factor	Variables (Order Specified)							Total R^2
	Sex	Grade	School	Race	Sex x Race	Grade x School	Race x School	
I	.15	1.59	11.76*	16.27*	.03	.88	.00	30.69
II	2.62*	2.99	4.05*	1.28	.47	1.69	.10	13.19
III	2.07*	13.47*	9.58*	.18	6.05*	10.59*	.13	42.07

[a] In percentages.

* $p<.05$

TABLE 6

Reconstructed ANOVA Table for Predetermined Order

Variable		d.f.	SS.	M.S.	F
Factor I:	Sex (V_1)	1	.207	.207	.30
	Grade (V_2)/V_1	2	2.168	1.084	1.59
	School (V_3)/V_1 V_2	2	15.983	7.992	11.70*
	Race (V_4)/V_1 V_2 V_3	1	22.1098	22.1098	32.37*
	Sex x Race (V_5)/V_1 ... V_4	1	.039	.039	.06
	Grade x School (V_6)/V_1 ... V_5	4	1.196	.299	.44
	Race x School (V_7)/V_1 ... V_6	1	.002	.002	.00
Factor II:	V_1	1	3.42	3.42	4.16*
	V_2/V_1	2	3.90	1.95	2.38
	V_3/V_1 V_2	2	5.29	2.65	3.23*
	V_4/V_1 V_2 V_3	1	1.68	1.68	2.05
	V_5/V_1 ... V_4	1	.61	.61	.74
	V_6/V_1 ... V_5	4	2.21	.55	.67
	V_7/V_1 ... V_6	1	.14	.14	.17
Factor III:	V_1	1	2.54	2.54	4.92*
	V_2/V_1	2	16.56	8.28	16.05*
	V_3/V_1 V_2	2	11.78	5.89	11.41
	V_4/V_1 V_2 V_3	1	.23	.23	.45
	V_5/V_1 ... V_4	1	7.44	7.44	14.42*
	V_6/V_1 ... V_5	4	13.02	3.26	6.32*
	V_7/V_1 ... V_6	1	.16	.16	.31

$p<.05$

TABLE 7

Mean and Standard Deviation on Variables for Indians and White

Variable	Indian			White		
	N	$\bar{X}$	S.D.	$\bar{X}$	S.D.	N
Scale 1	57	39.61	12.85	38.41	11.35	91
2	56	40.55	13.93	40.63	14.44	82
3	57	38.53	14.06	35.30	12.13	87
4	58	35.24	11.18	32.15	10.39	86
5	57	30.47	13.46	50.20	14.54	87
6	54	41.28	16.64	31.40	10.06	89
7	57	35.96	15.23	31.42	10.94	88
8	55	31.22	11.98	28.05	9.87	87
9	58	32.28	12.08	32.14	12.14	88
Raven's	55	99.89	14.96	110.07	11.24	88
Satisfaction	60	18.15	5.41	15.90	5.10	91
Friction	60	19.62	4.82	22.38	3.73	91
Competitiveness	60	20.72	3.63	21.18	3.86	91
Difficulty	60	15.25	3.70	14.89	3.20	91
Cohesiveness	60	22.92	3.80	19.48	2.91	91
Vocabulary	56	86.80	12.50	102.26	[illegible]	91
Reading	56	88.64	13.53	103.10	[illegible].00	91
Language	55	90.65	12.13	102.53	14.88	91
Mathematics	55	89.02	13.88	103.59	15.97	90